



Hydrogen Gas Generator

H2PEM-100 / H2PEM-165 / H2PEM-260 / H2PEM-510

User Guide

EN Original Language

aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding

Warranty

This warranty applies to the generator and associated parts (the equipment) manufactured and supplied by Parker Hannifin Ltd., Industrial Division (the company).

Use of the generator without the recommended water quality or genuine parts will expressly invalidate the warranty.

It should be noted that the generator must be installed and running within three months of dispatch from the company to ensure the optimum efficiency of the PEM cell. If this is not adhered to the warranty will be invalid. Should the equipment be defective as to materials or workmanship, the company warrants that it will remedy such defect. Where the equipment is the generator, the warranty period will be 12 months from date of commissioning or 18 months from date of manufacture, whichever comes first. Where the equipment is the PEM CELL, the warranty period will be 24 months from date of commissioning. In the case of equipment other than the generator, the warranty period shall commence from the date of dispatch.

Should any defect occur during the warranty period and be notified in writing to the company or its authorised distributor within the said period, the company will, as its sole option, remedy such defect by repair or provision of a replacement part, provided that the equipment has been used strictly in accordance with the instructions provided with each item of equipment and has been stored, installed, commissioned, operated and maintained in accordance with such instruction and with good practice. The company shall not be under any liability whatsoever under the warranty, if, before giving notification in writing to the company as aforesaid, the Customer or any third party meddles, interferes, tampers with or carries out work whatsoever (apart from normal maintenance as specified in the said instructions) in relation to the equipment or any part thereof.

Any accessories, parts and equipment supplied by the company but not manufactured by the company shall carry whatever warranty the manufacturer has given the company providing it is possible for the company to pass on such warranty to the customer.

To claim under the warranty, the goods must have been installed and continually maintained in the manner specified in the User Guide. Our product support engineers are qualified and equipped to assist you in this respect. They are also available to make repairs that may become necessary in which event they will require an official order before carrying out the work. If such work is to be the subject of a warranty claim, the order should be endorsed for consideration under warranty.

Where equipment is sold outside the UK mainland direct to the end user the warranty will cover parts only. Any substitution of parts not manufactured or approved by the company will expressly invalidate the warranty.

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1 Safety Information

Do not operate this equipment until the safety information and instructions in this user guide have been read and understood by all personnel concerned.

USER RESPONSIBILITY

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorised distributors provide product or system options for further investigation by users having technical expertise.

The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyse all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalogue and in any other materials provided from Parker or its subsidiaries or authorised distributors.

To the extent that Parker or its subsidiaries or authorised distributors provide component or system options based upon data or specifications provided by the user, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the components or systems.

Only competent personnel trained, qualified, and approved by Parker Hannifin should perform installation, commissioning, service and repair procedures.

This equipment is for indoor use only. Do not operate outdoors.

This equipment is not suitable for use in any Hazardous, Flammable, or Explosive environments. Hydrogen is a highly flammable gas. Keep the generator away from excessive heat and naked flames.

With the exception of oxygen, any gas can cause asphyxiation in high enough concentrations. In most scenarios, however, because hydrogen rises and disperses so rapidly, it is unlikely to be confined where asphyxiation might otherwise occur. Always ensure that the generator is operated in a well ventilated area and all of the vent ports on the rear of the generator are kept clear and free from blockages.

Use of the equipment in a manner not specified within this user guide may result in an unplanned release of pressure, which may cause serious personal injury or damage.

When handling, installing or operating this equipment, personnel must employ safe engineering practices and observe all related regulations, health & safety procedures, and legal requirements for safety.

Ensure that the equipment is depressurised and electrically isolated, prior to carrying out any of the scheduled maintenance instructions specified within this user guide.

Parker Hannifin can not anticipate every possible circumstance which may represent a potential hazard. The warnings in this manual cover the most known potential hazards, but by definition can not be all-inclusive. If the user employs an operating procedure, item of equipment or a method of working which is not specifically recommended by Parker Hannifin the user must ensure that the equipment will not be damaged or become hazardous to persons or property.

Most accidents that occur during the operation and maintenance of machinery are the result of failure to observe basic safety rules and procedures. Accidents can be avoided by recognising that any machinery is potentially hazardous.

Note: Any interference with the calibration warning labels will invalidate the gas generator's warranty and may incur costs for the recalibration of the gas generator.













Should you require an extended warranty, tailored service contracts or training on this equipment, or any other equipment within the Parker Hannifin range, please contact your local Parker Hannifin office.

Details of your nearest Parker Hannifin sales office can be found at www.parker.com/pag

Retain this user guide for future reference.

1.1 Markings and Symbols

The following markings and international symbols are used on the equipment or within this manual:

	Caution, Read the User manual.	 Warning	Highlights actions or procedures which, if not performed correctly, could lead to electric shock.
	Risk of electric shock.		When disposing of old parts always follow local waste disposal regulations.
 Warning	Highlights actions or procedures which, if not performed correctly, may lead to personal injury or death.		Conformité Européenne
 Caution	Highlights actions or procedures which, if not performed correctly, may lead to damage to this product.		Waste electrical and electronic equipment should not be disposed of with municipal waste.
	Wear disposable gloves.		Do not expose to naked flame.
 DO NOT OBSTRUCT VENT PORTS LEAVE OPEN TO ATMOSPHERE OR PIPE TO VENTILATED AREA WARNING GENERATOR MUST BE SHUT DOWN AND DEPRESSURIZED BEFORE PERFORMING ANY MAINTENANCE (REFER TO USER GUIDE)	DO NOT OBSTRUCT VENT PORTS LEAVE OPEN TO ATMOSPHERES OR PIPE TO VENTILATED AREA WARNING GENERATOR MUST BE SHUTDOWN AND DEPRESSURIZED BEFORE PERFORMING ANY MAINTENANCE (REFER TO USER manual)		
	This product has been certified by Underwriters Laboratories®.		

2 Description

This generator will produce a constant stream of high purity hydrogen at a predetermined flow rate and pressure when connected to a suitable power supply and fed with a suitable quality of deionised water. It is suitable for use in laboratories and light industrial environments and is non-hazardous for transportation purposes.

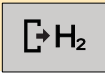

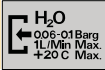




Caution

In order to guarantee the optimum efficiency of the PEM cell, this generator must be installed and running within three months of dispatch from Parker Hannifin. Failure to do this may invalidate the warranty. The generator will perform a 240 minute (4 hours) initialisation sequence when powered for the first time. This sequence, which cannot be aborted, is necessary to guarantee the correct hydration of the cell.



2.1 Technical Specification

This specification is valid when the equipment is located, installed, operated, and maintained as specified within this user guide.

	Units	H2PEM-100	H2PEM-165	H2PEM-260	H2PEM-510
Water					
Water quality		Deionised, ASTM II, >1 MΩ, <1µS, filtered to <100µm			
Consumption (Approximate) ¹	L/week	0.750	1.25	2	4
Supply pressure (max) ²	psi g (bar g)			1.45 (0.1)	
Supply flow rate (max) ²	cc/min			1000	
Supply temperature (max) ²	°F (°C)			68 (20)	
High Purity Hydrogen (H ₂)					
Outlet flow rate	cc/min	100	165	260	510
Outlet pressure	psi g (bar g)	5 - 100 ± 0.5 (0.3 -6.89 ± 0.034)()			
Purity ³	%	> 99.999%			
Mechanical Connections					
Hydrogen outlet		1/8" Compression fitting			
Water drain		Quick release push in fitting			
Automatic water fill inlet (factory or field fit option)		Blank			
Overflow drain		Quick release push in fitting			
Spillage drain		1/2" Barbed push on fitting			
Electrical Data					
Connection type		IEC320			
Supply voltage range	Vac	100-230 50/60Hz			
Power consumption ⁴	W	90	125	185	235
Fuse ⁵	A		5		
Environmental Data					
Ambient Temperature	°F (°C)	41–104 (5–40)()			
Relative Humidity	-	50% @ 104°F (40°C) (80% MAX < 87.8°F (31°C))			
IP Rating	-	IP20, NEMA 1, indoor use only			
Pollution Degree	-	2			
Installation Over voltage Category	-	II			
Maximum Altitude	ft. (m)	<6562 (2000)			
Noise	dB(A)	< 60			

1. Based on full flow with 24 hour 7 day operation at 22°C (72°F) ambient temperature.
2. Applies to generators with auto water fill only.
3. The balance is O₂ and moisture.
4. The power consumption when in standby mode is 20W.
5. Anti Surge (T), 250V, 5 x 20mm HBC, Breaking Capacity 1500A @ 250V, IEC 60127, UL R/C Fuse

2.2 Approvals

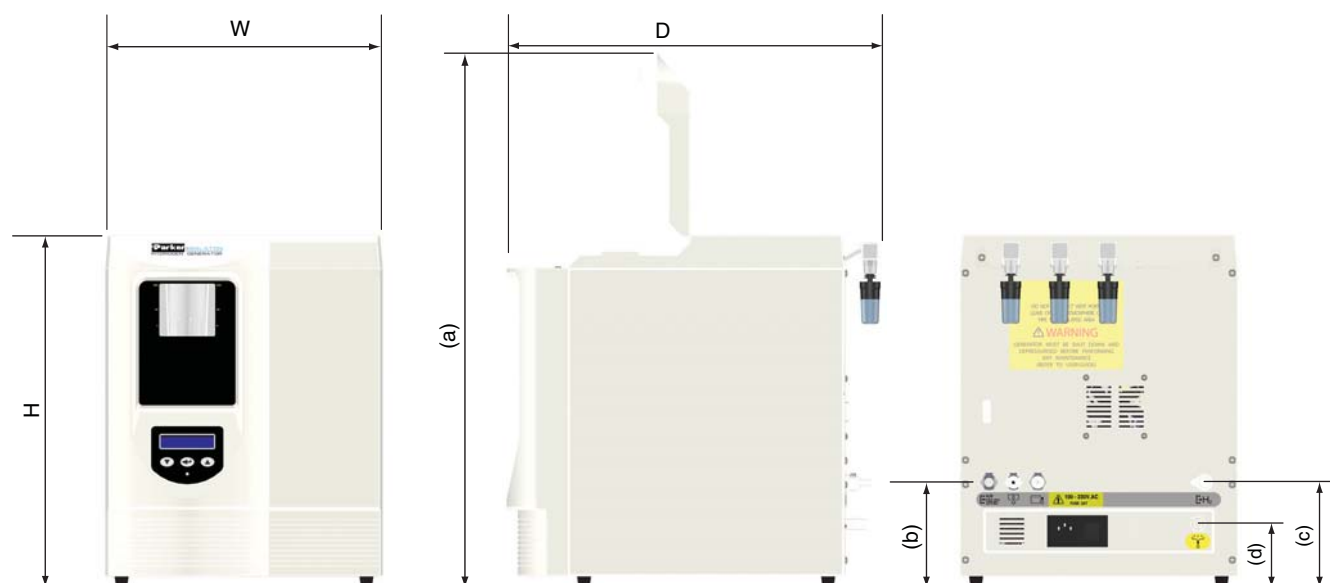
Safety and Electromagnetic Compatibility (EMC)	
	<p>This equipment has been tested and complies with the following European Standards:</p> <p>EN61010-1: 2001 — Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory use - Part 1: General Requirements.</p> <p>EN61326: 2006 — Electrical Equipment for Measurement, Control, and Laboratory use, EMC Requirements.</p> <p>EN50366: 2003 (+ A1: 2006) — Household and similar electrical appliances. Electromagnetic fields. Methods for evaluation and measurement.</p> <p>IEC 62233: 2008 — Measurement methods for electromagnetic fields of household appliances and similar apparatus with regard to human exposure.</p>
	<p>This equipment has been tested to and complies with the following standard:</p> <p>UL 61010-1 2nd Edition, "Electrical Equipment for Laboratory Use; Part 1: General Requirements.</p> <p>CAN/CSA C22.2 No. 61010-1 2nd Edition, "Electrical Equipment for Laboratory Use; Part 1: General Requirements.</p>
	

2.3 Materials of Construction

Facia and Covers	Noryl FN150 (R4G334/ AE251/1 Trimite coated)
Chassis	Mild Steel (Epoxy Powder Coated)
Seal Materials	Nitrile, Viton, EPDM, PTFE (tape)
Display Bezel	PA-765 ABS
Display Facia	Polyester film (Lumirror S10)
Deionised Water Circuit Tubing	Tygon, Natural PTFE
Hydrogen Circuit Tubing	Natural PTFE
Inlet/ Outlet Circuit Tubing	Cleaned* Stainless Steel 316 (Inlet/ outlet Piping)
Satellite filter	Polypropylene
Barbed Fittings	
Water Reservoir	Polyethylene
Float	
Conductivity Sensor	Polyvinyl Chloride
Floats	
Manifold, Bowl and Spigot	Natural Polycarbonate
JG Fittings	Acetyl
Conductivity Probes	Clean 316 Stainless Steel
Water Bottle to Pump Fitting	
Pressure Switch	
PEM Cell	Platinum and Titanium
Desiccant Cartridge (adsorbant)	Molecular Sieve MS 544/Clear Polycarbonate Cal. 300EP-22
Mounting Feet	Polyamide reinforced nylon and plated mild steel

2.4 Weight and Dimensions

The dimensions and weight of the equipment are specified below.



Dimension	Units	H2PEM-100	H2PEM-165	H2PEM-260	H2PEM-510
H	in (mm)	17.1 (435)	17.1 (435)	17.1 (435)	17.1 (435)
W	in (mm)	13.5 (342)	13.5 (342)	13.5 (342)	13.5 (342)
D	in (mm))	18 (457)	18 (457)	18 (457)	18 (457)
(a)	in (mm)	25.4 (645)	25.4 (645)	25.4 (645)	25.4 (645)
(b)	in (mm)	4.3 (108)	4.3 (108)	4.3 (108)	4.3 (108)
(c)	in (mm)	4.4 (111.5)	4.4 (111.5)	4.4 (111.5)	4.4 (111.5)
(d)	in (mm)	2.3 (59.5)	2.3 (59.5)	2.3 (59.5)	2.3 (59.5)
Weight					
Water bottle empty	lb (Kg)	41.9 (19)	41.9 (19)	41.9 (19)	41.9 (19)
Water bottle full	lb (Kg)	50.7 (23)	50.7 (23)	50.7 (23)	50.7 (23)

Table 2.2 Weight and Dimensions

2.5 Receiving and Inspecting the Equipment

On receipt of the equipment carefully inspect the packaging for damage. If the packaging is damaged inform the delivery company immediately and contact your local Parker Hannifin office.

2.5.1 Storage

If the equipment is to be stored prior to installation, do not remove it from the packaging. Ensure that it is stored in an upright position as indicated by the arrows on the packaging.



Do not attempt to lift the generator by yourself. It is recommended that the generator be carried by a minimum of two persons or transported on a pallet truck.

Note. The storage area should be secure and the environmental conditions should fall within those specified in the technical specification. If the generator is stored in an area where the environmental conditions fall outside of those specified, it is essential that it be moved to its final location (installation site) and left to stabilise prior to unpacking. Failure to do this could cause condensing humidity and potential failure of the generator.

2.5.2 Unpacking

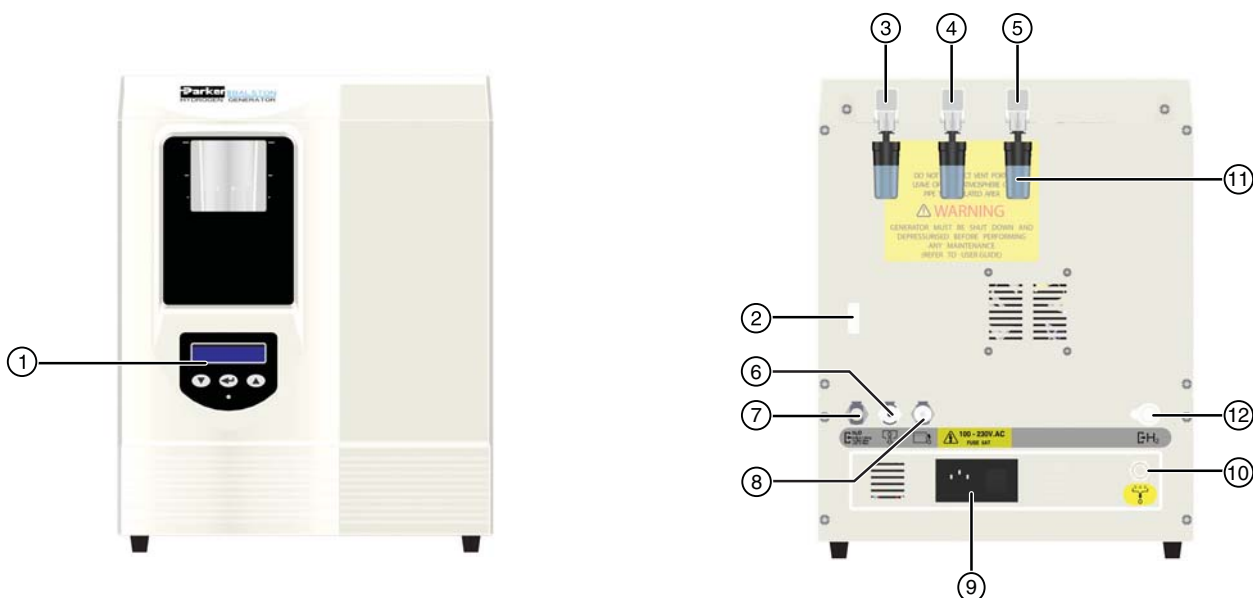
Once ready to install, remove the equipment from the packaging and check for signs of damage. Verify that the following items have been included with the shipment:

Description	Qty
Water drain tube	1
¹ Water fill tube	1
Deioniser cartridge	1
Environmental filters	3
Electrical supply cable	3

1. Supplied only with generators fitted with the water fill option.

If any items are missing or damaged please contact your local Parker Hannifin office. Do not attempt to power up the generator.

2.5.3 Overview of the equipment



Key:

1	Control panel	7	Auto water fill connection (factory or field fit option)
2	Options board connection port	8	Overflow drain
3	O ₂ Vent (<250ml/min)	9	Fused IEC 320 inlet socket and ON/OFF switch
4	Excess H ₂ vent (<1ml/min)	10	Water bottle spillage drain
5	Water bottle vent	11	Environmental filter
6	Water drain	12	Hydrogen Outlet

2.6 Locating the Equipment



This equipment is not suitable for use in any Hazardous, Flammable, or Explosive environments. Keep the generator away from excessive heat and naked flames.

2.6.1 Environment

The equipment should be located indoors in an environment that protects it from direct sunlight, moisture, and dust. Changes in temperature, humidity, and airborne pollution will affect the environment in which the equipment is operating and consequently may impair the safety and operation.

It is the customers' responsibility to ensure that the environmental conditions specified in table 2.1 are maintained.

2.6.2 Space Requirements

The equipment should be mounted on a flat surface, capable of withstanding the weight of the equipment and all ancillary parts. A minimum clearance of 150mm (5.9in) should be provided on all sides of the generator for air flow. Additional space should be provided so that the generator can be moved to allow unrestricted access to the generator during servicing and maintenance.

Do Not block the side vents or the fans located on the rear panel of the generator.

When considering the vertical clearance you must take into account the height required when the front upper access panel is in the open position. Refer to table 2.2 for overall dimensions of the equipment.

Do Not position the equipment so that it is difficult to operate or disconnect from the electrical supply.

2.6.3 Ventilation Requirements



The accumulation of hydrogen can displace oxygen thereby creating and asphyxiation hazard. Always ensure that the equipment is operated in a well ventilated area.

2.6.4 Water Supply Requirements

Generators fitted with automatic water fill system maintain the water level from a gravity fed fresh deionised water supply. Refer to "Technical Specification" on page 3 for the supply requirements.



The use of any water, other than deionised water (Deionised, ASTM II, >1 MΩ, <1μS, filtered to <100μm), within this generator will damage and reduce the life time of the hydrogen cell.

The generator should be connected to the supply using 1/4" Tygon or PTFE tubing (not supplied).

Note. The automatic water fill system is available as a factory or field fit optional extra. Contact Parker Hannifin for further details.

2.6.5 Electrical Supply Requirements

The equipment should be connected directly from the fused IEC 320 inlet socket to the electrical supply using the power cord supplied. The equipment should be positioned so that it can be connected to the electrical supply without the use of an extension cord.

It is the customers responsibility to provide a fused electrical supply to the equipment (Refer to table 2.1 for the electrical specification). It is recommended that this supply have surge protection.



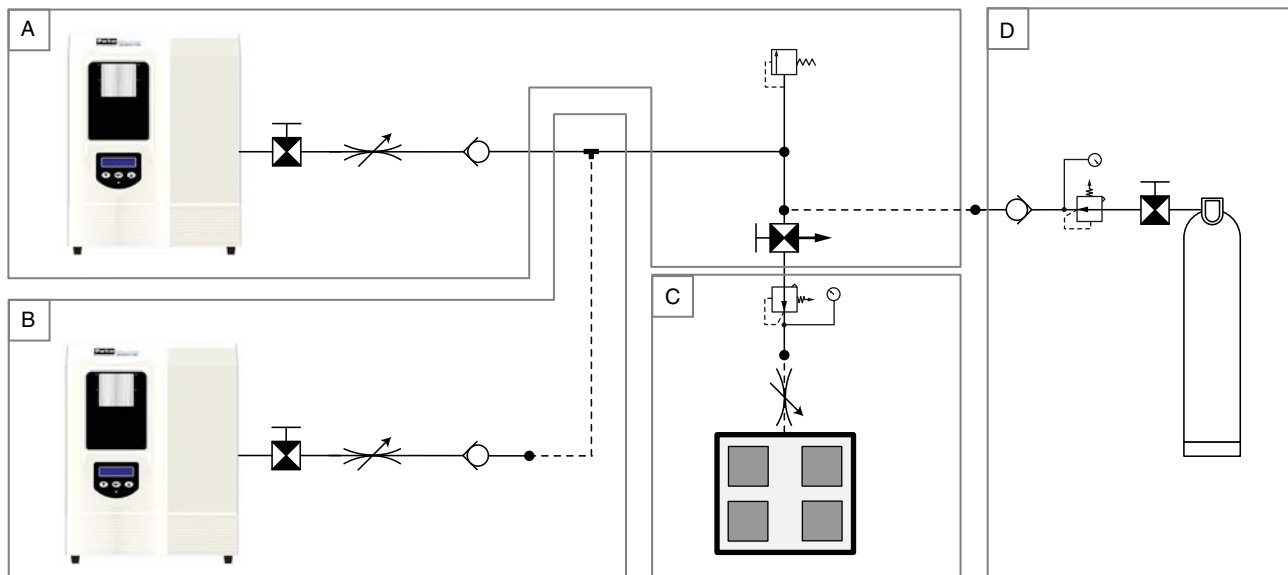
The equipment is connected to protective earth (ground) through the power cord. It is essential that electrical supply is equipped with a protective earth (ground) terminal. If an alternative power cord is used to connect the equipment to the electrical supply, ensure that it is suitably rated for the application and contains a protective earth (Ground) conductor.

3 Installation & Commissioning



Only competent personnel trained, qualified, and approved by Parker Hannifin should perform commissioning and service procedures.

3.1 Recommended system layout



A	Single generator	C	Application Instrument		Non return valve
B	Multiple generators	D	Back up supply		Flow Controller
	Isolation Valve		Pressure regulator		Pressure relief valve
	3-way ball valve with vent line.				

Note. The pressure regulator and flow controller shown in (C) are recommended to account for pressure drop across the piping. This may be integrated in to the application instrument.

3.1.1 Installation Parts.

Description	Part Number		
	Stainless Steel	Brass	Copper
1/8" OD Tube Ball Valve	2A-MB2LPFA-SSP	2A-MB2LPFA-BP	--
1/4" OD Tube Ball Valve	4A-MB4LPFA-SSP	4A-MB4LPFA-BP	--
1/8" OD Tube 3 Way Ball Valve	2A-MB2XPFA-SSP	2A-MB2XPFA-BP	--
1/4" OD Tube 3 Way Ball Valve	4A-MB4XPFA-SSP	4A-MB4XPFA-BP	--
1/8" OD Tube Flow Controller (0-1200 ml/min)	VCD-SVS-1500	--	--
1/8" OD Tube Non Return Valve	2A-C2L-1-BN-SS	2A-C2L-1-BN-BP	--
1/4" OD Tube Non Return Valve	4A-C4L-1-BN-SS	4A-C4L-1-BN-B	--
1/8" OD Tube Equal Tee	2ET2-316	2ET2-B	--
1/4" OD Tube Equal Tee	4ET4-316	4ET4-B	--
1/4" OD Tube Tee with 1/8" Side Port	4-4-2 JLZ-SS	4-4-2 JLZ-B	--
1/8" OD Tube Pressure Relief Valve	This relief valve should be sized by the installer to suit the installation		
1/4" BSPP Pressure Regulator	IR4003SK3SP24B		
1/8" BSPT (R1/8") to 1/8" OD Tube Connector	2MSC2K-316	2MSC2K-B	--
1/4" BSPT (R1/4") to 1/4" OD Tube Connector	4MSC4K-316	4MSC4K-B	--
1/8" OD Copper Tube (Grade B-280) (50 FT)	--	--	X50CT-2-30
1/4" OD Copper Tube (Grade B-280) (50 FT)	--	--	X50CT-4-30

Installation Parts display Parker Master Catalogue part number and may be ordered through your local authorised Parker Sales Company. Please note gas bottle and/or gas bottle regulator are not supplied by Parker Hannifin.

3.1.2 Installation Kit

Kit Number	Description
IK7532	Installation Kit including: Copper tube (50 ft), 1/8" tube nuts (x3), Front and back ferrules (x3), 1/8" tube T-pieces (x1)

3.2 Connecting the generator

3.2.1 Environmental filters

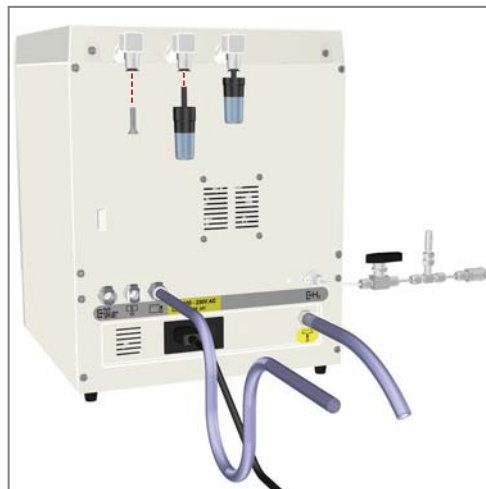
Remove the transit plugs from the vent ports, on the rear of the generator, and fit the environmental filters as shown.

3.2.2 Hydrogen outlet port

Refer to "Recommended system layout" on page 8 for the desired system configuration.

The generator should be connected to the application instrument using either high quality stainless steel tube or grade (B-280) copper tube. Remove the protective dust cap from the hydrogen outlet port compression fitting. Insert the tube into the outlet port fitting and rotate the tube nut until finger tight. Using a spanner (wrench) tighten the nut one and one-quarter (1 1/4) turns. When cutting the tubes always use the correct tools to allow a clean perpendicular cut. Cutting tubes will cause debris that, if not removed, may damage the downstream instrumentation. It is recommended that all pipes are purged to remove any debris that may exist. When routing the tubes ensure that they are adequately supported to prevent damage and leaks in the system.

All components used within the system must be rated to at least the maximum operating pressure of the equipment. Always protect the system by installing suitably rated pressure relief valves.



Warning

To prevent injury, and damage to the application instrument, the system piping will require purging for at least 15 minutes to remove any trapped oxygen. If using a 3-way ball valve with vent line, as recommended on page 8, ensure that the valve is open to the vent line and not to the application instrument. If a ball valve is not being used, ensure that the application instrument is not connected to the system piping. Refer to "Commissioning the Generator" on page 11 for details on purging.

3.2.3 Drain ports

The overflow drain and the water bottle spillage drain must be permanently piped away using 1/2" and 1/4" Tygon or PTFE tubing respectively. The tube connected to the overflow drain should have a u-bend to prevent contamination of the internal water bottle. Always check with local guidelines for disposing of deionised water.

3.2.4 Electrical supply

Check the rating plate for the correct supply voltage and frequency. Select the required power cord and connect it to the switched IEC 320 socket on the generator. Connect the plug directly to the electrical supply. Do not use an extension cord.

3.2.5 Filling the water bottle



Caution

The use of any water, other than deionised water (Deionised, ASTM II, >1 MΩ, <1μS, filtered to <100μm), within this generator will damage and reduce the life time of the hydrogen cell.

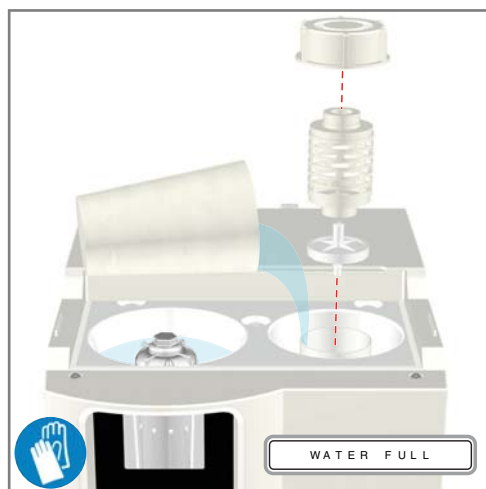
Fill the water bottle using fresh deionised water to a level approximately 15mm below the upper lip of the neck of the bottle. If the generator is powered up an audible and visual indication will be given when the correct level is reached.

Wearing suitable gloves to prevent contamination, insert the deioniser cartridge into the water bottle and fit the cap securely.

3.2.6 Water supply (generators fitted with Auto Water Fill)

The optional water fill allows the generator's water bottle to be gravity fed from a suitable deionised water supply. When the water level falls below the mid-point, the water bottle will be replenished from the deionised water supply.

Connect the deionised water supply to the automatic water fill inlet using the barbed adaptor provided and clean 1/4" Tygon (or similar) tubing. It is recommended that a balance line is fitted at the inlet to prevent air locks. Flush the line through to remove any trapped air. Refer to "Technical Specification" on page 3 for water supply requirements.



3.3 Options Board Accessory



The options board is designed for connection to Safe Extra Low Voltage (SELV) systems only. Maximum 12vdc 50mA.

The options board accessory allows direct communication with a PC via the USB port, and connection of water monitoring, remote alarm, and remote stop circuits.

3.3.1 Fitting the Options Board

Plug the options board into the 15-way D-type connector on the rear of the generator. The board should be secured in place using the retaining screw and spacer provided.

Place the cover over the options board and secure in place using the 2 retaining screws provided.

3.3.2 Wiring the Options Board

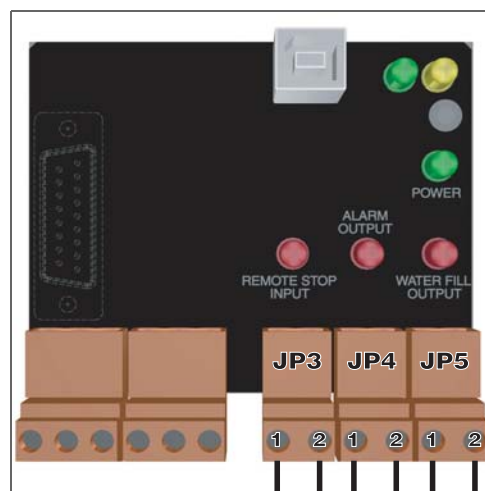
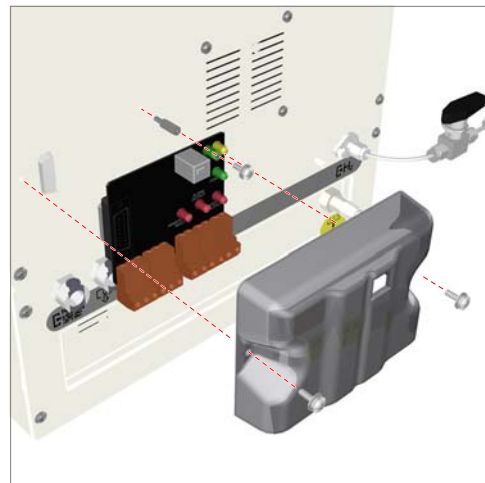
RS485	JP1_1	NOT USED (DO NOT CONNECT)
RS485	JP2_1	NOT USED (DO NOT CONNECT)
Remote Stop	JP3_1	Switched input
	JP3_2	GND
Alarm Output	JP4_1	Open collector output
	JP4_2	
Water Fill Output	JP5_1	Open collector output
	JP5_2	
USB	JP6	

JP3 Remote Stop—The remote stop function allows the generator to be connected to an external stop circuit. Press to reset the generator.

JP4 Alarm Output—The alarm output is designed for remote alarm indication. When an error occurs on the generator, the output switching circuit is activated causing the remote circuit to be complete.

The remote alarm circuit will be reset when the generator error has been reset.

JP5 Water Fill Output—The water fill output allows for remote monitoring of the water bottle level. When the water level drops below the mid-point in the water bottle the output switching circuit is activated. The circuit will only be de-energised when the water bottle is filled to its upper limit.



3.4 Commissioning the Generator



Ensure that a suitable vent line is provided during the commissioning stage as hydrogen will flow from the untermated system piping.



In order to guarantee the optimum efficiency of the PEM cell, this generator must be installed and running within three months of dispatch from Parker Hannifin. Failure to do this may invalidate the warranty. The generator will perform a 240 minute (4 hours) initialisation sequence when powered for the first time. This sequence, which cannot be aborted, is necessary to guarantee the correct hydration of the cell.

- 1 Referring to the recommended set up, use the 3-way ball valve to isolate the application instrument from the system and divert the flow to the vent line.

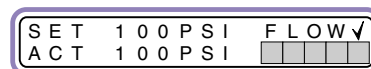
If a 3-way ball valve has not been installed, disconnect the application instrument from the system and connect the open ended piping to a suitable vent line.

- 2 Connect the generator to the electrical supply and switch it on at the wall socket. Turn the generator on at the power switch (located on the rear of the generator) and wait.



The generator will perform a system check during which time the water bottle indicators will illuminate blue then red, the system check LED will flash, and the software version number, generator serial number and the company banner will be displayed on the LCD.

On completion the generator will revert to the default menu as shown.



Note: Upon first use the generator may appear to stop building pressure while the separation chamber fills with water. Should this happen, restart the generator.

- 3 The internal pressure ("ACT" pressure) of the generator will build up to the required operating pressure ("SET" pressure).
- 4 Once the required pressure is reached, the outlet valve of the generator will be opened, as indicated by "F L O W ✓" on the display, and hydrogen will flow through the system piping and out through the atmospheric vent line.



Unless a high capacity moisture trap is fitted at the inlet to the application instrument, continue running in this state for up to 48 hours to reach the required purity. Failure to do so could damage the application instrument.

- 5 Close the 3-way ball valve to pressurise the system piping. Check for leaks and repair as required.
- 6 Open the 3-way ball valve to divert the flow to the application instrument.

During start-up the generator may revert to the last error mode it experienced. If this occurs press [⏮]. When the error is cleared the generator will continue with the start up procedure.

If the error cannot be cleared by this method follow the fault finding procedure in section 6 of this user guide.



If the pressure envelope of the system has been breached it will be necessary to run through this procedure when starting the generator.

4 Operating the equipment

4.1 Overview of controls



1	16x2 line menus display.	
2	Control key pad used for menu navigation and generator operation.	
3	Tri coloured System Check Indicator.	
	Indicator	Generator Status
	Flashing Green -	Start Up Initialisation
	Solid Green -	On-line
	Flashing Red -	Non Critical Errors
	Red -	Critical Errors (System Locked)
	Amber -	On-line, Service Required

4.2 Starting the equipment

Connect the generator to electrical supply and switch it on at the wall socket. Turn the generator on at the power switch (located on the rear of the generator) and wait.

The generator will perform a system check during which time the water bottle indicators will illuminate blue then red, the system check LED will flash, and the software version number, generator serial number and the company banner will be displayed on the LCD.

On completion the generator will revert to the default menu as shown.

Note: Upon first use the generator may appear to stop building pressure while the separation chamber fills with water. Should this happen, restart the generator.

The internal pressure ("ACT" pressure) of the generator will build up to the required operating pressure ("SET" pressure). Once the required pressure is reached, the outlet valve of the generator will be opened, as indicated by "F L O W ✓" on the display, and hydrogen will be supplied to the application instrument.

SET	1 0 0 P S I	F L O W X
ACT	9 0 P S I	

SET	1 0 0 P S I	F L O W ✓
ACT	1 0 0 P S I	



If the generator is being powered for the first time, it will take approximately 48 hours for the generator to reach the purity specified.

During start-up the generator may revert to the last error mode it experienced. If this occurs press [↩]. When the error is cleared the generator will continue with the start up procedure.

If the error cannot be cleared by this method follow the fault finding procedure in section 6 of this user guide.

4.3 Operating Menus

There are 9 menus used by the generator to display and access operational parameters and data. These can be accessed from the default menu by sequentially pressing [↩] on the control panel.

1		Default
2		Conductivity (water quality)
3		Pressure - units of measurement
4		Run time / Service interval
5		Flow
6		Error Log
7		Generator self test
8		Network node number
9		Cell hydration

4.3.1 Default Menu

The default menu displays the following data:

SET - The outlet pressure required by the application.

The required outlet pressure can be adjusted up and down using the [▲] and [▼] keys respectively.

ACT - Current actual internal / outlet pressure of the generator.

FLOW X / ✓ - Indicates the status of the generator outlet valve. "X" - Outlet is closed, "✓" - Outlet is open.

100% - The shaded blocks indicate the rate of hydrogen production. Each block represents 20% of the rated capacity of the generator.

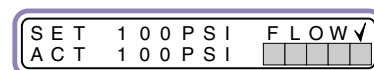
During initial start up, or after a massive pressure drop, all five blocks will be shaded indicating that the generator is building up pressure and not currently on line. When the generator is on-line and delivering gas to the application, the number of blocks shaded will depend upon the flow required by the application.

Stand by Mode—The flow of hydrogen to the application can be interrupted by switching the generator into standby mode.

Press and hold [↩] to select stand by. The default menu will change to the standby menu as shown to indicate that the outlet valve is closed and hydrogen is no longer being supplied to the application.

To return to normal operation, press [↩].

Reset—Pressing the enter key (middle key) during an error condition will reset the system.



4.3.2 Conductivity

The conductivity menu gives a graphical indication of the water quality. When all 10 blocks are shaded the water quality is to specification.

When the number of shaded blocks drops to four, the "Change Water" error message will be displayed, the water bottle indicator will flash red, and an intermittent alarm will sound. Hydrogen will continue to be delivered to the application.

If the water quality degrades to the point at which none of the blocks are shaded, the outlet valve of the generator will close and a conductivity error will be generated. The water bottle indicator will illuminate red and a continuous alarm will sound. Hydrogen will not be delivered to the application.

Press [←] to advance to the next menu.

CONDUCTIVITY
X [] [] [] [] [] [] [] [] [] [] ✓

Change Water
ACT 100 PSI [] [] [] [] [] [] [] [] [] []

Conductivity
ACT 100 PSI [] [] [] [] [] [] [] [] [] []



The water bottle should be drained and refilled with deionised water, ASTM II, >1 MΩ, <1µS, filtered to <100µm at the earliest convenient time.

4.3.3 Pressure Measurement

The units of pressure measurement may be changed between bar, psi and Mpa.

Press [▲] or [▼] to change the units of measurement.

When the desired units have been selected, press [←] to advance to the next menu.

PRESSURE UOM
PSI

4.3.4 Run Time Data

The Run Time Data Menu displays the following data:

HOURS RUN - Time in hours that the generator has been producing hydrogen.

SERVICE IN - The time in hours that the generator can produce hydrogen before a service is required.

HOURS RUN XXXXX
SERVICE IN XXXXX

4.3.5 Flow

The Flow menu displays the current flow and the total amount of hydrogen produced by the generator when on-line.

Flow ml/min. - Current flow in ml/min being produced by the generator. This is for indication only and we recommend the use of a flow meter to gain an accurate measurement.

Litres - Total amount of hydrogen produced by the generator measured in litres.

FLOW ml / MIN 000
LITRES 000

4.3.6 Error Log

The Error Log menu allows the user to access the 10 most recent error messages.

To access the errors press and hold [▲] and [▼].

The menu will display the most recent error, message number "0", along with the date and time of when the error occurred.

Use the [▲] and [▼] keys to scroll through the remaining error messages. Press [←] to return to the error log menu.

ERROR LOG
HOLD ▼ & ▲

DD / MM / YY HH : MM 0
* DESCRIPTION *

4.3.7 Generator Self Test



The generator must be disconnected from the system when running the self test routine.

From the Self Test Menu press and hold [▲] and [▼]. As the generator runs through the test routine, the menus will change as follows:

Pressure release— All pressure within the generator is released. The test will not proceed until the generator is fully depressurised.

Pressure build—The generator is pressurised to a maximum operating pressure of 6.89 bar g (100 psi g). The time taken to reach this pressure is monitored by the generator.

PRESSURE RELEASE
100 PSI ← CANCEL

PRESSURE BUILD
100 PSI ← CANCEL

Pressure Hold—The pressure is held for a predetermined time and the monitored for decay.

Pressure Release—The outlet solenoid valve opens to release all pressure within the generator.

Test Passed / Failed—Once fully depressurised the generator switches to standby and the result of the test is displayed.

NOTE Always perform a self test whenever the pressure circuit has been disturbed e.g. changing the desiccant cartridge.

PRESSURE HOLD
100 PSI ← CANCEL

PRESSURE RELEASE
100 PSI ← CANCEL

TEST PASSED
STANDBY

4.3.8 Network Node Number

Up to 27 generators can be networked together, and their status monitored remotely using Parker Hannifin's RemoteNet software. In order for the generator to be recognised on the network it must be assigned a Node number (1-27). If the node number is set to zero the generator will not appear on the network.

The Network Node number is set through the generator's menu system as follows:

- 1 From the Set Network Node menu press and hold [↩] & [⏮].
- 2 Use the [⏮] or [⏭] keys to select the required node number and press [⏮].
- 3 Press [↩] twice to return to the default menu.

SET NETWORK NODE
HOLD ▼ & ▲

Note. Do not assign the same node numbers to different generators as this will cause communication errors.

Contact Parker Hannifin for further details on the RemoteNet software.

4.3.9 Cell Hydration Sequence

The cell hydration sequence should be run if the generator has not been powered up for 90 days or more.

From the default menu press [↩] seven times to navigate to the cell hydration menu. Press and hold both [⏮] and [⏭] to initiate the sequence.

The sequence takes approximately 240 minutes (4 hours) to complete, however it may be aborted at any time by pressing [↩]. On completion press [↩] twice to return to the default menu.

CELL HYDRATION
HOLD ▼ & ▲

CELL HYDRATING
XXX:XX EXIT ←

4.4 Hard Reset

If a critical error occurs an error lock menu will be displayed and the generator will need to be hard reset. If an overpressure, H₂ or O₂ vent blocked error occurs, the generator will need to be hard reset once the problem has been resolved. This will also be the case if the same error is reset 3 times consecutively.

Before a hard reset is performed the initial fault must be rectified; refer to "Error Messages" on page 21 for guidance. When the faults are rectified, switch the generator off at the mains switch.

Press and hold [↩]. At the same time reapply the power to the generator. When the generator has powered up press [⏮] again. The generator will reset all errors then continue with the normal start up procedure.

4.5 Stopping the equipment and depressurising



Ensure that the generator is fully depressurised prior to shipment or servicing.

- 1 Ensure that the application instrumentation no longer requires hydrogen.
- 2 Switch the generator off at the mains power switch and disconnect it from the electrical supply.
- 3 Slowly disconnect the Hydrogen outlet connection pipe from the side of the generator allowing the system to depressurise.



Hydrogen gas will escape under pressure when the piping is disconnected.

- 4 The generator is now shut down.
- 5 If the generator is to be transported drain the water from the generator as described in section 6. Refit the hydrogen outlet port cover and the three transit plugs to the O₂ vent, excess H₂ vent and the water bottle vent.










5 Servicing













The recommended service procedures identified below, along with all other repair and calibration work, should be undertaken by a Parker Hannifin approved engineer.

5.1 Cleaning



Clean the equipment with a damp cloth only and avoid excessive moisture around any electrical sockets. If required you may use a mild detergent, however do not use abrasives or solvents as they may damage the warning labels on the equipment.

5.1.1 Service Intervals

Component	Operation	Daily	Weekly	6Months (4000Hrs.)	12Months (8000Hrs.)	24Months (16000Hrs.)
Generator	Check the power ON indicator is illuminated.					
Generator	Check the STATUS / FAULT Indicator on the control panel.					
Generator	Check the water level.					
Generator	Check the water conductivity.					
Generator	Check the water bottle spillage drains					
Generator	Check for leaks.					
Generator	Recommended Service A 6 Month Service.					
Generator	Recommended Service B 24 Month Service.					
Generator	Recommended Service C Check the desiccant cartridge and replace if opaque.					

Service	6 Months (4000 Hrs.)	12 Months (8000 Hrs.)	18 Months (12000 Hrs.)	24 Months (16000 Hrs.)	30 Months (20000 Hrs.)	36 Months (24000 Hrs.)	42 Months (28000 Hrs.)	48 Months (32000 Hrs.)	54 Months (36000 Hrs.)	60 Months (40000 Hrs.)	66 Months (44000 Hrs.)	72 Months (48000 Hrs.)
A												
B												

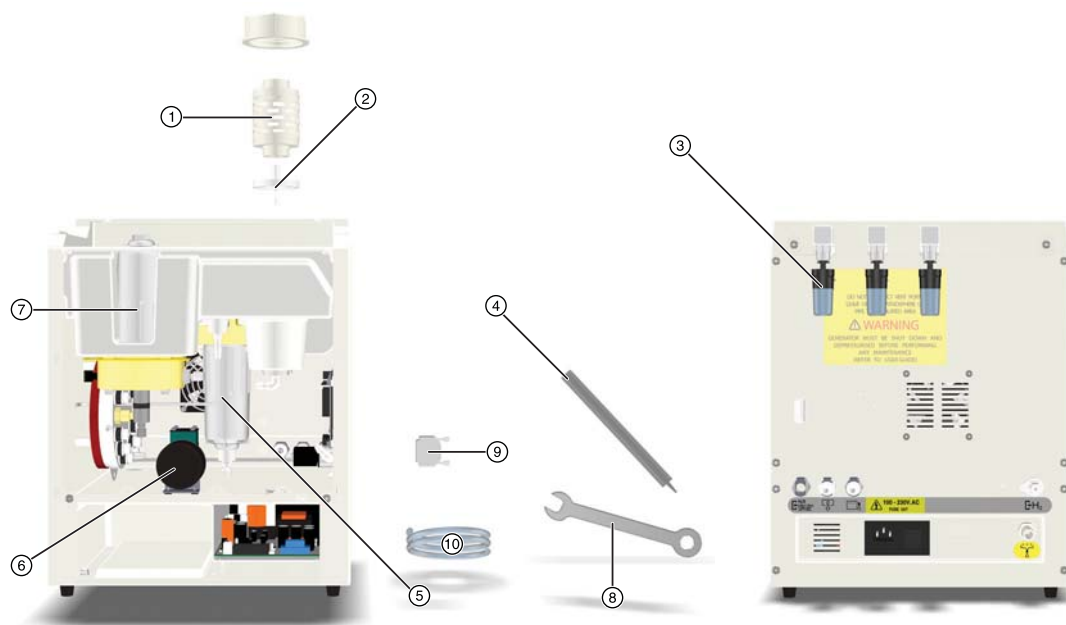
Key:

	Check		Essential Procedure		
---	-------	---	---------------------	--	--



Servicereminder.com is a web based reminder service developed to track when service work is due to be carried out. This ensures that parts can be ordered in advance and that the service is carried out at the optimum time in accordance with the manufacturers recommendations. This service is free to use, simply log on to www.servicereminder.com and select New User Registration.

5.2 Service Kits



5.2.1 Recommended Service A - Required every 4000Hrs (6 months)



Description	Catalogue Number	Technical Reference	Contents
Filter Service	MKH2PEM-6M	MKH2PEM-6M	(1) Deioniser cartridge (2) 100 micron water filter (3) Environmental filters (x3) (4) Filter replacement tool

5.2.2 Recommended Service B - Required every 16000Hrs (24 months)



Description	Catalogue Number	Technical Reference	Contents
Complete Service	MKH2PEM-24M	MKH2PEM-24M	(1) Deioniser cartridge (2) 100 micron water filter (3) Environmental filters (x3) (4) Filter replacement tool (5) Float (6) Water pump (7) Desiccant cartridge (8) Cartridge spanner (wrench) (9) Service reset dongle (10) 1/4" Tygon tube

5.2.3 Recommended Service C - As required



Description	Catalogue Number	Technical Reference	Contents
Replace Cartridge	MKH2PEM-D	MKH2PEM-D	(7) Desiccant cartridge (8) Cartridge spanner

Note: The desiccant cartridge should be changed as and when required, however it is recommended that it is changed at least every 6, 4, and 2 months on the H2PEM-100 / H2PEM-165, H2PEM-260 and H2PEM-510 respectively.

5.3 Consumable Replacement Procedures

5.3.1 Draining the water bottle (A)

Locate the drain port on the rear of the generator and insert the drain line (1). Ensure that the line is locked in position to obtain a complete seal. Leave the water to drain into a suitable container, then press the lock (2) downwards and remove the line.



In order to prevent contamination and prolong the life of the cell do not reuse the old water.

5.3.2 Replacing the deioniser cartridge and 100 micron water filter (B)



Change the deioniser cartridge every 4000 hours (6 months), or if it has become contaminated.



Switch the generator into Stand by mode and remove the top front cover and the water bottle cap.

Wearing disposable gloves, remove the deioniser cartridge (3) and discard. Extract the 100 micron water filter (4) using the H₂ filter replacement tool (5). Push the tool over the filter so that the webs on the filter fit into the slots on the end of the tool. Unscrew the filter and remove it from the water bottle.

Fit the replacement filter and ensure that it is secured into the water bottle. Refill the water bottle with deionised water, ASTM II, >1 MΩ, <1µS, filtered to <100µm, as described below, and fit the replacement deioniser cartridge.

Refit the water bottle cap and the top front cover and restart the generator.

5.3.3 Replacing the Environmental Filters (C)

Remove the three environmental filters (6) from the vent ports by pushing the push in fitting (7) upwards to release. Fit the replacement filters and check that they are secure.

Note: Environmental filters should be changed every six months as there is no visual indication of exhausted filters.

5.3.4 Replacing the Desiccant Cartridge (D)

Depressurise the generator as specified in "Stopping the equipment and depressurising" on page 15.

Remove the top front cover. Break the seal of the cartridge using a size 19mm open ended spanner (wrench) (8) and then unscrew it by hand. Remove the cartridge and fit the replacement. The new cartridge should be tightened by hand and then nipped up, by a further 1/8th of a turn, using the 19mm spanner (wrench).

Refit the top front cover and the outlet fitting. Restart the generator and initiate a self test as described in "Generator Self Test" on page 14.

5.3.5 Filling the water bottle (E)



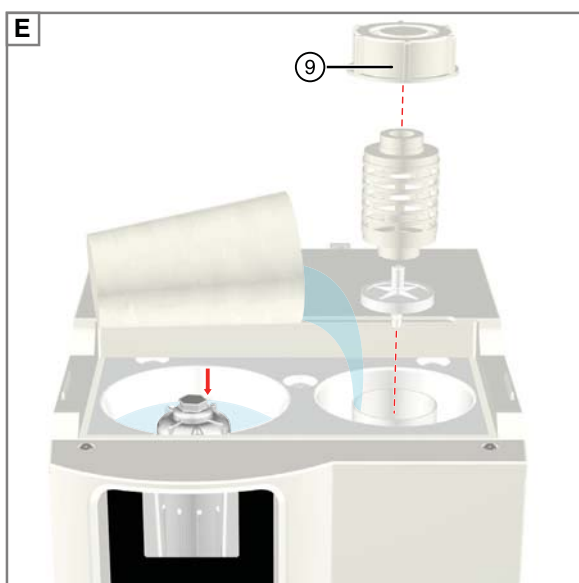
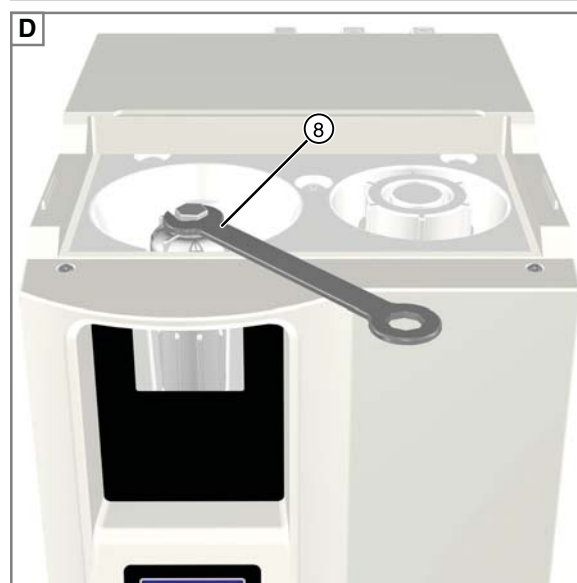
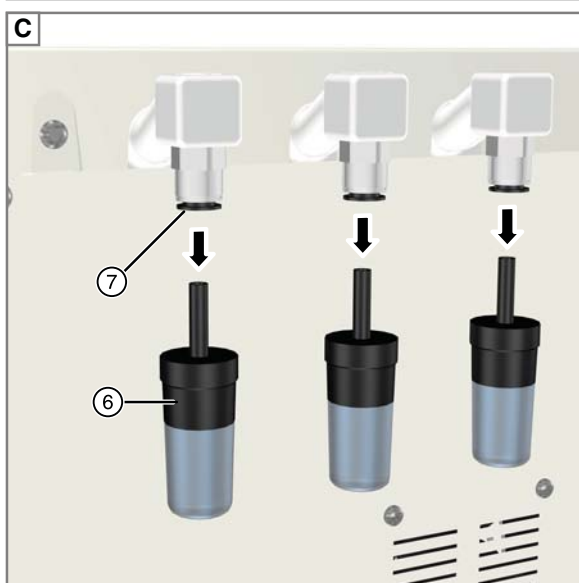
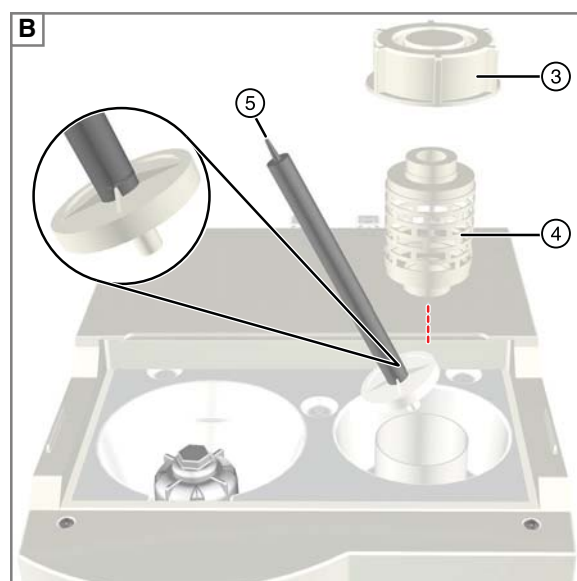
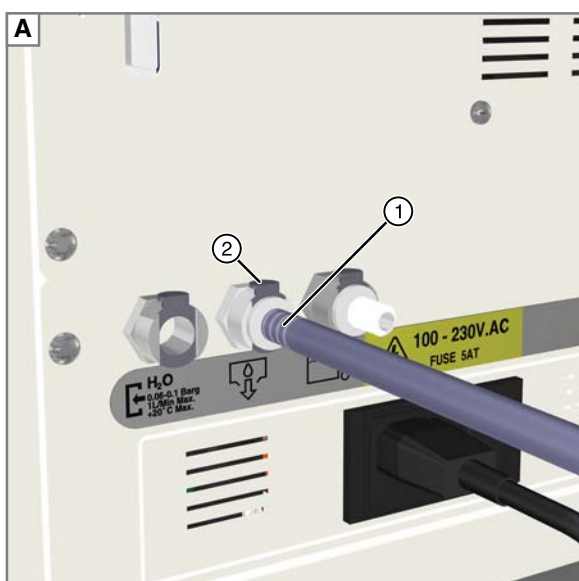
The use of any water, other than deionised water (ASTM II, >1 MΩ, <1µS, filtered to <100µm) within this generator will damage and reduce the life time of the hydrogen cell.

Remove the top front cover and the water bottle cap (9). Fill the water bottle using fresh deionised water to a level approximately 15mm below the upper lip of the neck of the bottle.

If the generator is powered during refilling, an audible and visual indication will be given by the generator when the correct level is reached, and the LCD will display "Water Full" message. Once full replace the water bottle cap and top front cover.

Note: If the water has been changed due to high conductivity, the deioniser cartridge must also be changed.














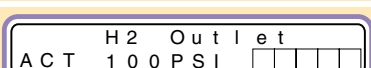
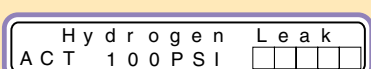
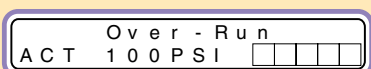

5.4 Service Record



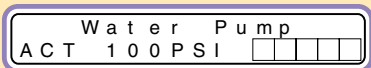
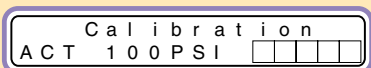
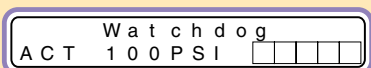



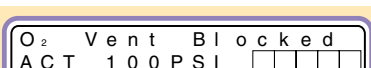
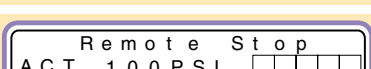
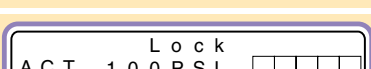
Generator Details	
Model Number:	
Serial Number	
Supply Voltage	
Commissioned By:	
Company Name	
Address:	
Telephone:	
Fax:	
Contact Name:	
Date of Commission:	

Service Interval Months (Hours)	Date	Serviced By		Comments
		Print	Sign	
6 (4,000)				
12 (8,000)				
18 (12,000)				
24 (16,000)				
30 (20,000)				
36 (24,000)				
42 (28,000)				
48 (32,000)				
54 (36,000)				
60 (40,000)				
66 (44,000)				
72 (48,000)				
78 (52,000)				
84 (56,000)				
90 (60,000)				
96 (64,000)				
102 (68,000)				
108 (72,000)				

6 Error Messages

When an error occurs the LCD will cycle between the default menu and the error message. In addition to the error messages the generator will provide a visual and audible indication using the System Check LED, Water Bottle Indicator and its integral sounder.


No.	Error Message		H2 Production	Action
1		The water has dropped below the mid-point.	Yes	Fill with deionised water, ASTM II, >1 MΩ, <1μS, filtered to <100μm.
2		Water has dropped below minimum point.	No	
3		Water conductivity is high.	Yes	Drain the water bottle and refill with deionised water, ASTM II, >1 MΩ, <1μS, filtered to <100μm.
4		Water conductivity is unacceptably high.	No	
5		The hydrogen cell voltage is too high.	No	Contact Parker Hannifin for advice.
6		The hydrogen cell voltage is too low.		Reset / Hard reset the generator. If the problem persists contact Parker Hannifin.
7		The hydrogen cell current is too high.		
8		The hydrogen cell current is too low.		Contact your service agent for advice.
9		Hydrogen leak in the internal pressure system.	No	Check that the drying cartridge is fitted correctly. Check the internal pressure circuit. If the problem persists contact Parker Hannifin for advice.
10		Massive pressure loss.	No	Check outlet piping and connections. If the problem persists contact Parker Hannifin for advice.
11		Internal leak.	No	Check that the drying cartridge is fitted correctly. Check the internal pressure circuit. If the problem persists contact Parker Hannifin for advice.
12		The generator is operating above 100% rated capacity or running to atmosphere.	No	Check for external leaks on the outlet of the generator. Verify that the generator is specified correctly for the application. If the problem persists contact Parker Hannifin for advice.
13		Maximum internal pressure is exceeded.	No (System locked)	Depressurise the generator and perform a hard reset. If the problem persists contact Parker Hannifin for advice.

No.	Error Message	H2 Production	Action
14		There is a fault with the conductivity sensor.	No
15		There is a fault with the pressure transducer or wiring.	
16		There is a fault with the water pump.	
17		The calibration file is out of date.	
18		Internal software time out.	
19		There is a fault with the float chamber water level transducer.	
20		There is a fault in the float chamber; the water level is too high.	Yes
21		A service is required.	
22		The oxygen vent is blocked.	
23		The terminals on JP3 of the options board are short circuit.	
24		Pressure error, O ₂ vent blocked or three consecutive errors of the same type have occurred.	No (System locked)

Contact Parker Hannifin for advice.

Perform the required service.

Remove the blockage and perform a hard reset.
If the problem persists contact Parker Hannifin for advice.

Press  when required to reset the generator.

Resolve the initial fault and reset the generator.

7 Declaration of Conformity

Declaration of Conformity

EN

Parker Hannifin Ltd, Industrial division
Dukesway, TVTE, Gateshead, Tyne & Wear, NE11 0PZ. UK

Laboratory Hydrogen Generator
H2PEM-100, H2PEM-165, H2PEM-260, H2PEM-510

Directives 2006/95/EC
2004/108/EC

Standards used EN 61010-1 : 2001 + CORR 1 & 2
EN 61326 : 2006
EN 50366 : 2003 (A1 : 2006)
IEC 62233 : 2008

PED Assessment Route : N/A
EC Type-examination Certificate: N/A
Notified body for PED: N/A

Authorised Representative Derek Bankier
Divisional Quality Manager
Parker Hannifin Ltd, Industrial Division

Declaration

I declare that as the authorised representative, the above information in relation to the supply / manufacture of this product, is in conformity with the standards and other related documents following the provisions of the above Directives.

Signature:



Date: 27/11/07

Declaration Number: 0045/271107

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